

DIGITAL INNOVATION CHALLENGE LOS RETOS DE LA INNOVACIÓN DIGITAL



Horizon 202 European Union Fundi Research & Innova



SMILE **Smart Island Energy Systems** WP4 - Madeira Island Pilot **Data Transformation**

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In Madeira the SMILE project is focused in developing technologies to make the electrical grid smarter, especially

- Increasing the amount of self-consumption in photo voltaic (PV) owners
- Stabilizing the grid in areas with a high amount of PV injection into the grid

Implementing smart charging techniques for electric vehicles.





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These overalls goal led to the development and deployment of several hardware/software components:

- Energy monitors
- o PV systems

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- o Smart chargers
- Battery Storage Systems

All the equipment communicates with a centralized entity known as the **Energy Management System (EMS)**.

Responsible for aggregating all the data and providing APIs for the basic CRUD operations
To be used by the project partners during the pilots operation





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The EMS is stores the data in a series of noSQL and SQL databases

In general all the data that reaches the EMS is formatted in the JSON format.

However the actual pilots equipment uses different protocols/data formats

- Modbus-RTU
- \circ JSON
- \circ uart
- o HTTP

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- o IEC61851
- Serial/Rfid





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The data transformation is accomplished by a piece of custom hardware installed sm;)e every pilot location

The gateway

Regarding the data pipeline in SMiLE the gateway is responsible for

- Reading data from the different equipment
- Formatting to the JSON format
- Pushing it to the EMS
- Storing local backups
- Pushing raw data for another persistent storage server
 - o Backup server





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The development of the gateway increased the overall cost of each installation

However it is a crucial component to assure the proper integration of all the equipment.

- Especially considering that the project attempts to evaluate in the real world how different smartgrid approaches can impact the grid quality, as well as its consumers
- With this approach we guaranteed that all the hardware/software upstream of the actual smartgrid hardware *"talks the same language"* which is important when there is the need to test new equipment.
- Or to interface equipment that which were not supposed to (e.g. equipment from different manufacturers)



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Madeira Pilot – data transformation



In detail – Integration with of consumption from an energy meter

The gateway communicates with an Carlo Gavazzi Energy Meter, using the ModBus-RTU protocol.

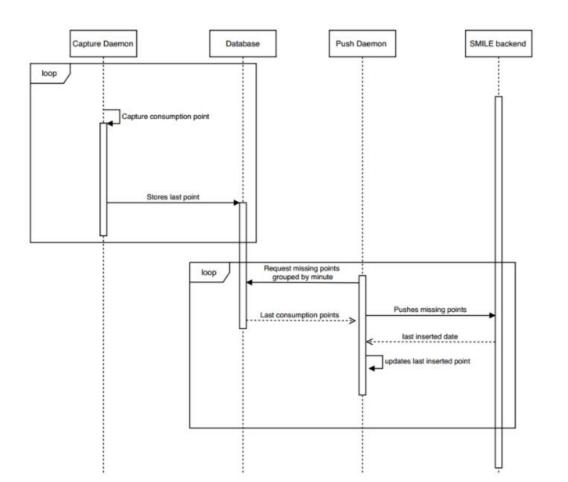
A series of python scripts are responsible for:

- o acquiring the data from the energy monitor
- \circ ~ averaging for the required frequency
- pushing data for the backend
- verifying the data was sent correctly
- averaging the data for a csv file
 - uploading for a google drive backup account



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In detail – Integration with of consumption from an energy meter







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In detail – Integration with of consumption from an energy meter

The EMS aggregates the consumption data together with data from other pilot sites.

- It used a document based database
 - \circ The sources of the data can be customized per pilot
 - \circ The schemas used to define the data format can be customized
 - For the gateway->energy meter case-study the schema is

DIGITAL INNOVATION CHALLENGE

Madeira Pilot – data transformation

id" : ObjectId("5a69c4f39e0312c306bc423c"), "type" : "jsonListener", "config" : { "slug": "carlo-usage", "producerRequired" : true, "converter" : { "L3" : { "PF":{ "type" : "identity" }, "I":{ "type" : "identity" }, "V" : { "type" : "identity" }, "S" : { "type" : "identity" }, "Q" : { "type" : "identity" }, "P" : { "type" : "identity"

"L2" : { "PF":{ "type" : "identity" }, "I" : { "type" : "identity" }, "V":{ "type" : "identity" }, "S" : { "type" : "identity" }, "Q" : { "type" : "identity" }, "P":{ "type" : "identity" "L1":{ "PF":{ "type" : "identity" }, "I":{ "type" : "identity" }, "V" : { "type" : "identity" },

"S" : { "type" : "identity" "Q" : { "type" : "identity" }, "P":{ "type" : "identity" "F":{ "type" : "identity" "timestamp" : { "type" : "datetime", "typeParams" : { "format" : "YYYY-MM-DDTHH:mm:ssZ" "measure cons": { "type" : "identity" "measure prod":{ "type" : "identity" "measure_grid" : { "type" : "identity" "name" : "carlo-usage" ζ,

v" : 0



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In detail – Integration with of consumption from an energy meter

Once in the EMS the data is available in an admin and visualization tool

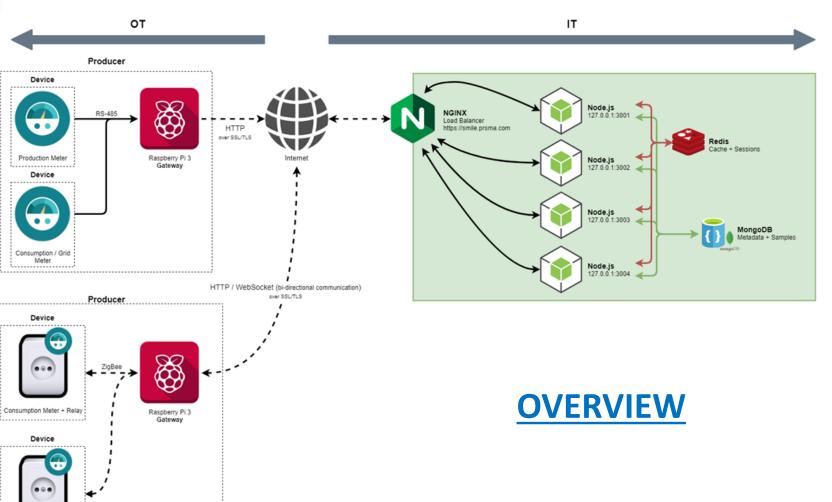
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Home					
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		∦ FIK_UVA	23 devices	€ eGauge	36 device
		# Tukxi	7 devices	plugwise-usage	14 devices
		∦ EV	6 devices	SUltraSonicWaste	7 devices
Térmica 🔜 Hídrica 🔜 Eólica 📗	Biomassa	A Plugwise_Office	5 devices	ev_usage	6 devices



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Madeira Pilot – data transformation



Consumption Meter + Relay

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Questions?

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